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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY
FOREST INSECT INVESTIGATIONS

Re--INSPECTION OF INSECT CONDITIONS IN THE HARNEY AND
BLACK HILLS NATIONAL FORESTS

Memorandum for Regional Forester, Denver, Colorado
(For the attention of Mr. Thompson)

By

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Halsey, Nebraska
October 5, 1933.

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An examination of insect conditions in the Black Hills was made during the week from September 10 to 17. This inspection was primarily to check up on the development of Ips bark beetles infesting slash left from thinning ponderosa pine stands at CCC camps. During the first two days slash areas and recently piled poles were examined at Camp Pactola, Camp Mystic and the Hill City camp with Inspector Nelson, accompanied the second day also by Supervisors Conner and Krueger. During the next three days at Camp Mayo, with Mr. Sieker from the Custer office, a similar examination was made as well as an inspection of parts of the sawfly defoliated areas and the blowdown on the Harney Forest. Several thinning areas at Camp Custer were looked over next, and at the end of the week the piled poles near Pactola re-examined and in addition a few observations made on the tip moths. On the return trip to Halsey part of the 18th was spent at the Nebraska State CCC camp in Chadron State Park to briefly survey bark beetle conditions.

The Ips situation as it appeared from the first two days of examination had been discussed with Forest officers at the time but before leaving the Black Hills a brief letter was sent to each Forest indicating that no new developments had been found which would seem to warrant any additional or unusual recommendations for this fall. Besides the bark beetles a few observations on other insects will be included in this report.

THE IPS SITUATION

No killing of standing green trees in the thinning areas from summer attacks of Ips was found and none reported. Apparently the continuous supply of fresh slash provided readily absorbed all of the attacking beetles. The development of Ips did not keep pace with the great amount of slash supplied and as a result most of the poles felled since early August were practically uninfested except for a comparatively few and scattered new attacks. This was apparently due to a slower development by the end of the second generation of Ips than had been anticipated for the Black Hills and the lack of a general flight in late August and early September. At the time of the examination most of the beetles were still concentrated in the slash cut approximately during the last half of July, a majority of the insects being in the new adult and pupal stages. A considerable amount of the material cut during this period had been attacked by Ips although there were not enough beetles to infest all of the slash and many of the attacked poles had been only partially filled in. However, the number of beetles in the aggregate in these areas was considerable.

Practically the only species of bark beetle found infesting the thinning slash was Ips oregoni (Eichh.), a fairly small species measuring about 4.5 mm. in length. Most of the felled material ranged from small saplings to poles five and six inches d.b.h. Ips oregoni develops successfully in much of this slash, attacking poles as small as two inches or slightly less in diameter. Woodborer larvae, both roundheads and flatheads, were common in much of the older slash. Little evidence of parasites was found but the larvae of a predaceous Clerid beetle, which feeds on bark beetle larvae, was present in small numbers.

As to the time of flight and attack of Ips oregoni, it appears that there was a flight of overwintering adults beginning with seasonal activity about the last of May and probably continuing during the first half of June; another main flight during the last half of July and possibly into early August - with a few attacks in between these periods. Following this there apparently had been little flight up to the middle of September, the few new attacks found being recent with few of the egg galleries extending more than an inch. In the small amount of early June slash examined all but a very few of the Ips had emerged, the flight from this generation making the attacks in the late July slash in which, as stated, most of the beetles were still concentrated in the advanced stages. A fair number of predaceous larvae still inhabited the early June slash. It is possible that additional Ips attacks will occur this fall but the extent of these is uncertain, being dependent on whether the new adults in the July ^{slash}_{emerge} or remain there for the winter.

Consequently it appears that the only possibility of Ips damage this fall is that some of the late emerging beetles might attack standing trees in preference to the down material. There is certainly a plentiful supply of fresh slash on the ground if this is preferred, and the few beetles in flight the first half of September, evidently taking to the down slash. With the uncertainty of fall damage it would not seem expedient to undertake any drastic control measures at this time. Furthermore, the only possible measure under present conditions would be to attempt to collect and burn all of the scattered infested material, if this could be accomplished in time, and such an undertaking would probably outweigh any damage that seems likely to occur this season.

In the piles of fresh poles, started at a number of camps about the first of September, very few Ips attacks were found 10 and 15 days after piling - an occasional pile had attracted a few beetles, others none. This of course was due to the absence of a general flight at this period. Not enough Ips were being collected to warrant a continuation of any extensive piling as a means of trapping and destroying the insects. However, it did seem advisable that at least some of these piles be left for the remainder of the season, and perhaps a few made for experimental purposes at camps where none had been prepared, and examined occasionally to determine whether or not beetles would still be attracted in any numbers. These piles could be disposed of or burned at any time in late fall or during the winter, because of the lateness of the attacks, if they collect any quantity of Ips. It was expected that the State would soon begin hauling out charity fuel from some of the camps and it was recommended that where the late July cutting areas were to be included in the work that this material, still containing many beetles, be removed first. However, many of the July areas

are inaccessible due to the expectation that the beetles would be leaving this slash by early September and accumulating in recent thinning areas which had been left at accessible points.

Last spring, with the lack of any previous observations on the seasonal history of Ips in the Black Hills, the periods of flight and attack had to be estimated. It was known that Ips oregoni could develop a complete generation in five or six weeks and from this it was anticipated that the second generation would mature and probably be flying by early September. Many new adult had developed by this time but it was evident that little flight had occurred up to September 15th. It is still uncertain if this is a normal annual condition as in seasons with temperatures above normal it is possible for this beetle to develop as much as two weeks earlier than in years with a late cool season. No weather records have been examined to compare temperatures of the past summer with the normal, and there were apparently no weather records kept at Custer which could be used at the time.

The fact that the camps in the Black Hills are continuing for at least another six months and thinning will progress throughout the winter also altered somewhat last spring's view of the Ips situation. At that time it was expected that cutting would cease suddenly in early fall and without suitable down slash many of the beetles might attack standing trees. Such damage might not have occurred until the following summer since the larger poles from the later cuttings would still be moist enough the next spring to attract Ips, but by July if this material had dried out the second flight of beetles would either leave the areas in search of normal host material or concentrate in nearby standing trees. Of course this potential danger still exists when thinning operations stop. Ips oregoni has already multiplied to a considerable extent and undoubtedly will continue to increase next season. It is possible also that the infestation might taper off gradually at the close of the operations, however, it seems that as long as the Ips continue to multiply the chances of damage will likewise increase. The predaceous Clerid beetles will perhaps increase at the same time and be of some benefit but they are unable to control a rising beetle infestation. The increase of woodborers may also be of some value as they often destroy much of the food of the bark beetle larvae where the two occur in association in considerable numbers.

If Ips damage does eventually occur it will probably not be scattered but limited to areas in which the beetles were last concentrated, that is, any green trees killed are apt to be in the vicinity of the slash from which the beetles emerge. After the attack of the one generation in standing, healthy trees the infestation usually dies down, from what evidence we have on this type of Ips damage. It also appears that these primary attacks of Ips in saplings and small poles in the Black Hills may occur as readily in midsummer as in the fall, in fact the July attacks may prove to be the principle period for such damage especially if very little flight takes place during the fall. This seems to have been the case around certain log decks and cull logs where the few instances of Ips damage in the Hills has been examined. At a skidway pointed out by Mr. Krueger during this trip, where logs had apparently been decked during the winter and not hauled out until some time in summer, a fringe of saplings and small poles varying from 1 1/2 to 8 inches d.b.h. and in groups of from 10 to 25 trees had been attacked and killed by Ips this season.

Several groups of these trees were entirely faded and the beetles emerged and had evidently been attacked in early June when the Ips were attracted to the area, but some of these trees had been seriously burned at the base and were perhaps in a weakened condition. The other groups of apparently healthy trees were just starting to fade and still contained many new adult Ips besides a few pupae and larvae and these trees had evidently been attacked the last half of July by Ips that had developed in the log decks. Two years ago on the Harney, adjacent to several cull logs cut about April with no further cutting in the area, Ips had developed in these culls and attacked a group of trees in an adjacent young stand - the beetles being mostly in the pupal and advanced larval stages at the last of August. The beetle causing this particular damage was identified as Ips integer (Eichh.), which resembles Ips oregoni quite closely. At the same place the previous year several groups of small trees next to felled logs had been killed by Ips, but the time of cutting and period of attack could not be determined. In these cases it appears that the lack of fresh slash in the vicinity, after the Ips had multiplied during the one generation in the logs, might have been the reason for the attack on healthy small trees.

Regarding the burning of piles of pôles for a short period in June at certain camps for Ips control, it was reported that some of these piles contained a considerable number of Ips and consequently many beetles must have been destroyed. This undoubtedly assisted in reducing the potential increase of beetles in these areas. At camps where no burning was done it may be found that in some cases the Ips infestation is little different from the others, but this would vary with the number of beetles in the locality which were attracted to the earlier cuttings. Where thinning was not started until late June the earliest emerging beetles would already have made their attacks on normal host material in the forest and only the late emerging Ips and those of the following generation would have been attracted to the slash areas. The effectiveness of piling and burning next spring would depend upon the attractiveness of the piles as compared to the scattered winter cut slash. It is possible that the more recent cut and piled slash would attract more beetles and the carrying out of some such measures would seem justified in an attempt to check the continued increase of Ips.

To summarize briefly the Ips situation in the Black Hills:

Apparently no summer killing of standing green trees occurred in the thinning areas because of the large quantity of fresh slash continuously provided for Ips attack. The possibility of some fall damage is still uncertain, being dependent upon the number of beetles emerging and the type of host material preferred. There is a great quantity of suitable uninfested slash available and if this is preferred there should be little or no damage this season.

The principle species of bark beetle attacking the thinning slash is Ips oregoni. It appears that there were two main periods of flight and attack by this beetle during the summer; one from the last of May to about the middle of June; the next approximately during the last half of July. Comparatively few attacks were made during August and the first half of September. In the second week in September the beetles were found still concentrated largely in the late July slash, mostly in the new adult and pupal stages - this apparently being the end of the second generation. It was indefinite whether many of these new adults would fly and attack yet this fall or pass the winter in the July slash. Although the first

generation did not increase to numbers sufficient to infest all of the slash cut the last half of July the number of Ips in the aggregate in these areas is considerable.

It seems now that the greatest potential danger of Ips damage in the thinned stands may be following the close of thinning operations when no further slash is provided. If damage in this event does result it will very likely be limited to stands in which the beetles are last concentrated. Any measures, such as an attempt to attract and burn Ips in freshly piled poles next spring or by the disposal of Ips infested material, would seem justified to prevent a continued increase of the beetles.

SAWFLY INFESTATION

The pine sawfly, defoliating ponderosa pine on the Harney National Forest the past summer, was apparently concentrated at a half dozen or more local centers of infestation scattered over a reported area of two or more townships - from east of Custer south around and west of Pringle. Two of these local centers visited, one a few miles southwest of Camp Mayo, the other several miles west of Pringle, each covered roughly a half section or more of timber in which trees of all sizes had been seriously defoliated. The feeding of the sawfly larvae had been limited largely to the old foliage but where this had been depleted even some of the current needles had been consumed.

The new cocoons were found in the soil under the litter, some more than an inch below the soil surface. The cocoons contained both larvae and new adults apparently ready to emerge, in fact several adult sawflies pushed the end off their cocoon and crawled out within a few minutes after being dug up. It would seem from this that the adults might emerge and deposit their eggs this fall, the insect overwintering in the egg stage, although this is not certain. The eggs are probably deposited in slits made along the needles by the saw-like ovipositor of the females.

From the abundance of cocoons found at the one point where they were examined it appears that the infestation will continue next year. Another defoliation of the most severely effected trees may result in some early mortality, particularly among the overmature trees which will put out but very little new growth next year. It is impossible to predict what turn the epidemic might take or how much damage might eventually result. In many cases local infestations subside normally in a few years but there are also a few records of widespread damage from sawfly infestations. It is possible that parasites will multiply rapidly if the epidemic continues and control the infestation, as has been found in certain defoliator outbreaks. The larva of a parasite was found in several of the cocoons but they were evidently not yet numerous. A wet season might also prove detrimental to the pest, retarding development and encouraging insect diseases. About the only artificial control measures would be spraying or dusting the infested trees with a stomach insecticide.

BLOWDOWN AREA

An enormous volume of timber was blown down during a severe storm in the Black Hills last May. The cyclone causing this started near the west boundary of the Harney Forest and practically cleaned a strip of timber about a mile wide and running in a north and easterly direction for some 20 miles across the Harney and then for many more miles across the Black Hills National Forest. The estimated volume of ponderosa pine destroyed on the Harney alone, as recalled now, was something like 30 or 40 million board feet. Many of the uprooted trees still have a few unbroken roots in the ground and these will likely remain green for several years. Under such conditions there is always the possibility of *Dendroctonus* beetles multiplying in the blowdown and eventually starting an infestation in healthy timber.

An examination was made of down trees and stubs at half a dozen points in the lower five or six miles of the area. No evidence of the Black Hills beetle, *Dendroctonus ponderosae* Hopk., was found in the trees examined. A number of the down trees were lightly infested by Ips, both *Ips oregoni* and the larger species, *Ips ponderosae* Swaine. Some of the down trees were putting out enough pitch to form small reddish pitch tubes at the point of Ips entrance. The Black Hills beetle has apparently been rather scarce on the Harney in recent years and any that might have been attracted to the blowdown this season would doubtless be difficult to locate unless areas were known where this beetle occurred. The only indications of this particular *Dendroctonus* observed during the examination of the thinning slash were three isolated galleries in recently piled poles.

THE PINE TIP MOTHS

Injury to the buds and new shoots of ponderosa pine by the tip moths seems to have been more prevalent this year in the Black Hills region than usual. This type of damage is certainly more common than was found in the summer of 1926, when a brief study was made of the tip moths. At that time it was determined that the two species found in Nebraska, *Rhyacionia frustrana bushnelli* (Busck), and *Rhyacionia neomexicana* (Dyar), also occurred in the Black Hills. However, the latter was apparently very scarce and from a collection of infested tips only one adult was reared as compared to numbers of the smaller *R. frustrana bushnelli*. This fall a number of the cocoons of *R. neomexicana*, containing the larger sized pupae, were readily found in the bark crevices at the ground line of the few large saplings examined and it appears that this species is much more common than in 1926 and this increase may be largely responsible for the current prevalence of tip moth injury. Several cocoons containing the smaller pupae of *R. frustrana bushnelli* were found in the litter where they commonly pupate.

Another type of injury noted on the current year's growth was a killing of many of the new needles soon after they started to elongate. A small hole in the bundle sheath indicated that some insect had entered by this means and apparently fed on the base of the expanding needles. This type of work, which often occurred on the leaders and on trees of all sizes, was fairly conspicuous in some localities. These short, dead needles on the new shoots gave the impression at first that tip moth damage was occurring

in some unusually tall trees, but an examination of some of the felled trees showed that much of it was this needle injury, the buds and shoots not being hollowed out as with tip moth work but solid and apparently normal enough to continue growth next year. Some tip moth injury was found in the tops of trees as tall as 30 and 35 feet but this was light as compared to the damage to shoots of the saplings in the same vicinity.

The cause of a similar type of needle injury common on native pine in northern Nebraska is the work of the larvae of two species of small moths. Whether one or both of these moths might be responsible for the needle killing in the Black Hills cannot be determined at this time of the year, and it is possible that the damage may be caused by an entirely different insect. This injury to the new needles and the destruction of part of the new shoots by the tip moths becomes particularly serious in the sawfly defoliated areas since the old foliage and most of the new foliage are apt to be destroyed in the same season.

CHADRON STATE PARK, NEBRASKA

The Ips situation at the CCC camp in Chadron State Park was found quite similar to that in the Black Hills. Evidently no summer Ips killing had occurred; only a few new attacks were found in recently cut poles; many of the Ips were in the new adult stage; much uninfested fresh material was on the ground available for fall attacks; and the possibility of some of the late emerging beetles attacking green standing trees was uncertain. More of the Ips were found in the larger cull logs, from the removal of overmature trees, both Ips oregoni and the larger Ips ponderosae being present. The broods were more mixed up, that is more developing larvae were found although the main generation seemed to be in the new adult stage. Practically all of the material cut in the Park is to be disposed of for fuel or hauled out for private use during the fall and winter, except for brush and smaller slash that might be used for erosion control. Consequently this disposal of all of the larger slash should reduce any increase in the Ips population that has taken place during the past summer.

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